SOUTHERN CALIFORNIA EDISON "LIVING" PILOT

THE FRACTALGRID MODEL FOR DEPLOYING AND INTEGRATING PREFERRED RESOURCES

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Specialized Energy Solutions (SES), a wholly owned subsidiary of Harper Construction Company, Inc. (HCC), appreciates the opportunity to provide input as the Commission considers how to address capacity constraints with preferred energy resources. We wish to use this opportunity to bring to the Commission's attention an innovative CEC-funded microgrid project under development in collaboration with the Naval Facilities Engineering Command (NAVFAC) Southwest, at Camp Pendleton, and to suggest ways in which this model could be expanded to cost-effectively deploy and integrate preferred resources in a populated area.

A truly integrated approach to preferred resources would break down the historical wall between demand-side and wholesale energy resource procurement. It would allow customers the flexibility to procure power systems matched to their particular requirements, e.g. lowest cost, price stability, green power, or ultra-high reliability.

Furthermore, such an approach would enable customers to interact with the grid, providing services to the utility in exchange for a fee, e.g. ancillary services, flexible ramping, resource adequacy, capacity, energy, environmental attributes, etc. An informed customer would then be able to optimize their power system with the provision of these services in mind.

Finally, with the wall between demand and supply broken down, the Investor-Owned Utility itself might wish to own behind-the-meter equipment to secure provision of desired services, and offer additional services to its customers (e.g. ultra-high reliability) to improve the cost-effectiveness of its investment.

This vision is currently obstructed by technical, financial, and regulatory impediments. The Living Pilot should address all three. By the time SCE is ready to procure, SES will have made significant progress in solving the technical challenges associated with such implementations. As such, SES wishes to participate in the Living Pilot to assist the CEC, CPUC, and CAISO in addressing the remaining regulatory and financial barriers, and to integrate new markets and rules into its technical solution, enabling utilities and ratepayers to work together and cost-effectively integrate preferred resources in Southern California and beyond.

On July 8, 2013, HCC and SES were awarded a $1,722,890 PIER grant to develop and demonstrate a set of nested microgrids (the "FractalGrid") interconnected with existing concentrating and flat panel solar photovoltaics (CPVs & PVs) as well as Plug-in electric vehicle (PEV) charging. SES is also deploying an innovative 60kW, 120kWh kinetic energy storage system with total ownership costs projected to be a fraction of current battery technologies.

The next phase of development for the FractalGrid is to build an open, standards-based microgrid infrastructure platform that is infinitely extensible with expanded capabilities applicable to a broad range of commercial and industrial ratepayers of all loads and profiles. This open platform will utilize existing best-of-

breed interoperability standards and protocols such that organizations, vendors, and individuals can develop and customize customer-facing microgrid solutions. By the time the Living Pilot procurements are issued, SES will have gained operational experience from the Camp Pendleton FractalGrid, and will be ready to deploy FractalGrids within the constrained Serrano and Ellis corridors.

The expanded capabilities proposed will demonstrate the viability of distributed solutions to California's growing power challenges with high-penetration renewables integration. For a microgrid to play an optimal role in solving this challenge, it must not only ensure its own operational reliability, but also interact with the grid as a whole (the "macrogrid"). Thus, each node on a FractalGrid must be capable of managing its own resources and maintaining appropriate levels of reliability and power quality. It must also be capable of efficiently dispatching its assets in response to signals from or commitments to the macrogrid. Table 1 illustrates only a few of the highlighted inputs, outputs, and assets planned for deployment on a FractalGrid. Note that the items in *italics/red* text fall under the scope of the initial PIER grant.

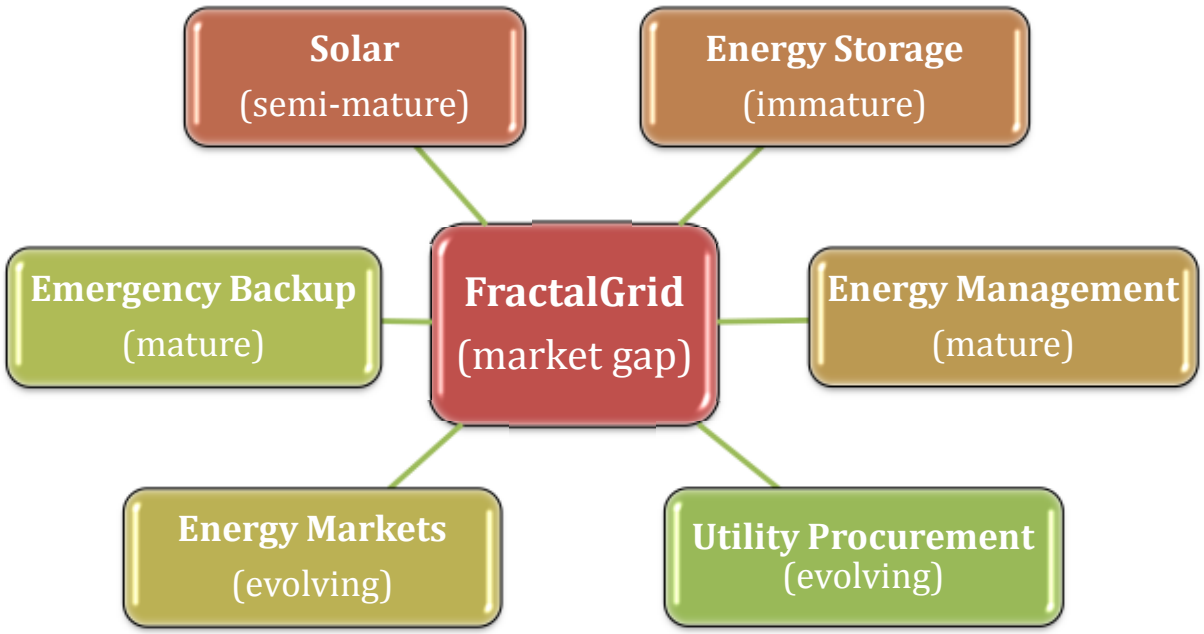
Inputs	Outputs	Assets
OpenADR signal	*Economic curtailment protocols*	*Distributed generation*
Critical peak pricing data	*Emergency curtailment protocols*	Dispatchable loads
Time-of-Day tariff	*Energy Storage controls*	Critical/Non-critical loads
Demand peak reduction	*Volt/VAR support*	*Energy storage*
Power quality sensor feeds	*Export/Import power controls*	*EV Charging, V2G/V2H*
Grid outage information	*Export VAR*	*Emergency backup generation*
Meteorological data	*Decision support GUI*	4 quadrant control inverters
ISO demand forecast	*Optimization simulation*	*Communications network*

Table 1: Inputs, Outputs, and Assets for the Camp Pendleton FractalGrid. *Italicized/Red* items funded by PIER.

FILLING THE INTEGRATION GAP

In the early phases of our transformation to a more sustainable power grid, several systems have evolved relatively independently to solve specific needs. California's commercial and industrial ratepayers commonly use energy management systems of widely varying sophistication. Simple thermostats and timers have evolved to accommodate occupancy sensors and later demand response signals triggering temperature set-point changes or other demand side resources.

Independently, solar PV systems have evolved to take advantage of net metering, and diesel backup generators have covered critical loads during infrequent power outages. None of these systems has been designed to communicate with the other; indeed there was little reason to contemplate such interoperability given the policies governing the use of each technology (e.g. strict limits on the use of emergency backup generation, and full retail net metering credit for solar).



The inclusion of cost-effective energy storage in a microgrid changes these rules; by adding a variable, it radically expands the set of potential strategies that might be profitably employed at any given time. It also enables a far greater level of market participation by effectively making a ratepayer's short-term energy demand more elastic.

As SES expands the FractalGrid's capability beyond the Camp Pendleton project's focus on critical load preservation, it will enable far greater commercial and industrial ratepayer response to market signals, sophisticated tariffs, and fast-responding automated demand response (ADR) through the coordinated deployment of demand-side resources with distributed generation and storage. In addition, it will enable the development of new models for utility-owned resources to be distributed cost-effectively throughout the grid.

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